Selection of Pru p 3 hypoallergenic peach and nectarine varieties

To the Editor,

Peach is an important fruit consumed worldwide. However, it is also one of the most frequently reported allergenic fruits[1]. Component diagnosis of peach allergy indicates Pru p 1, Pru p 2, Pru p 3 Pru p 4, Pru p 7 and Pru p 9 are involved [2, 3]. Pru p 3 is the dominant allergen responsible for severe allergic reaction[4] and it is considered to be the primary sensitizer to other LTPs in Mediterranean and Central Europe [5].

The levels of Pru p 3 differ between varieties [6]. To date, measurement of Pru p 3 in a limited number of peach and nectarines from Spain, US and Italy has been reported[7]. Significant variation of allergen concentration in processed foods containing peach has also been observed [8]. The content of Pru p 3 of peach/nectarine determines the potential risk for peach allergic patients.

China is the origin of peach with representative genetic diversity to be explored for hypoallergenic varieties[9]. A core collection of 103 varieties cultivated in Jiaxing, Zhejiang Province were selected to represent this diversity, including 23 nectarines and 80 peach varieties (with fruit hair, round or flat, 77 cultivated, three wild) (Supplementary Table 1). The soluble solid content (SSC), ripening date and peach aroma intensity were recorded. Specific methods are detailed in the Supporting Information. Pru p 3 was quantified by ELISA based on our previous research [6].

Significant differences in Pru p 3 content were identified in individual varieties (P<0.0001) (Figure 1A). Most nectarine varieties had low Pru p 3 content with pedigree of ‘Armking’ and ‘Mayfire’ (Supplementary Table 1), while a large variation was observed in peach: the lowest (3.5μg/g) in a wild peach, and the highest (64.4μg/g) in flavorsome yellow flesh peaches. In cultivated peach and nectarine, the level was higher than in wild varieties, and usually higher in peach than nectarine. In addition, fruit harvest month greatly influenced the Pru p 3 content (P<0.001). Peach varieties ripening late generally had higher levels than earlier ones: 40.19 μg/g on average for varieties ripening in August/September, about three times the level of

those in May (Figure 1B). Fruit flesh color also reflected the Pru p 3 content (P=0.0072, n=100). The results showed that hypoallergenic varieties were mainly yellow flesh nectarines and red flesh peaches (Figure 1C, D). Correlation analysis between Pru p 3 and soluble solid content (SSC) and the influence of aroma showed that higher Pru p 3 content related to higher SSC (P=0.0006, r=0.3394, n=98) and stronger aroma (P=0.0002) (Figure 1E, F), indicating that good quality peaches had high allergenic potential. The Pru p 3 content of flat peaches, becoming more popular in Mediterranean countries and China, is expected to be high, as demonstrated in Supplementary Table 2. There was 4% to 30% variation between years (2016-2018) for the same variety. The distribution of Pru p 3 in different parts of peach fruit differs greatly: the content in peel was 13 to 60 times higher than in pulp (Supplementary Table 2).

Immunocytochemical observations of Pru p 3 in four varieties with significantly different Pru p 3 content showed striking differences. In low Pru p 3 content ‘Hu You 278’ (nectarine, 4.02μg/g) (Figure 1 G1) and peach variety ‘Xue Bu Dai’ (red flesh, 4.00μg/g, Figure 1G2), small amounts of Pru p 3 was located in the pericarp layer, and less in the mesocarp. In high Pru p 3 content yellow flesh peach variety ‘Mei Jin’ (37.42μg/g, Figure 1G3) and ‘Jin Shuo’ (57.89μg/g, Figure 1G4), the fluorescent signals were clearly stronger than ‘Xue Bu Dai’ and ‘Hu You 278’ in both the pericarp and mesocarp cells. All three peach varieties (with hair) (Figure G2, 3, 4) contained high Pru p 3 in the hair. These results were consistent and data are shown in Supplementary Table 2. The Pru p 3 content in the pulp of a yellow flesh peach cultivar such as ‘Jin Shuo’, was higher than that in the whole fruit of some nectarines or red flesh peaches. This indicates that, although peeling the fruit is theoretically an effective way to reduce Pru p 3, it is not always practical and does not always alleviate the risk of peach allergic reaction. The correct choice of variety is better.

Skin prick testing (SPT) was performed on nine patients from Shanxi and Zhejiang provinces, recruited on the basis of their clinical history and a positive peach ImmunoCAP. All of them had provided written informed consent and approved by the

local ethics committee (authorization No. 2011-R-1, Second Affiliated Hospital, College of Medicine, Zhejiang University), in collaboration with the Third People's Hospital of Datong, Shanxi (authorization No. 2015-001). The identified low Pru p 3 'Hu You 278' (nectarine, 4.02μg/g) and high Pru p 3 variety 'Mei Jin' (peach cultivar, 37.42μg/g), according to our quantification and immunocytochemical localization, were tested to assess the sensitization of varieties with different Pru p 3 content in allergic individuals. All nine allergic subjects had a positive SPT to fresh peach cv 'Mei Jin', higher than those with nectarine cv Huyou 278, and one patient was negative to nectarine (Table 1). ImmunoCAP results showed that 9/9 were positive to peach，7/9 positive to Pru p 3 and /or Art v 3, 2/9 positive to Pru p 4 and none of them positive to Pru p 1 (Table 1).

In summary, Pru p 3 content differed considerably depending on the variety, related to fruit type, flesh color and ripening date. Low risk varieties were nectarines and red flesh peach, maturing in May to July and with low or mild fruit quality. This research provides a directive for evaluating potential Pru p 3 levels for patients and clinical doctors. We identified several hypoallergenic nectarines (May Fire, Hu You 278) and three red-flesh peach varieties 'Xue Bu Dai', 'Zi Xue Tao' and 'Wu Yue Xian'. Because of the narrow genetic background of nectarines worldwide from limited founder cultivars such as 'Armking' and 'Mayfire', hypoallergenic nectarines are recommended for further clinical trials.

Legend

Figure 1. Comparison of Pru p 3 content in different variety groups and immunocytochemical localization of Pru p 3 in low and high content varieties.

A: Pru p 3 content in different fruit types. **B**: different harvest month. **C**: flesh color of nectarines. **D**: flesh color of peaches. **E**: Influence of soluble solid content (SSC) and **F**: aroma intensity. **G**: Immunocytochemical localization of Pru p 3 in (1) 'Hu You 278', (2)- 'Xue Bu Dai', (3) 'Mei Jin' and (4) 'Jing Shuo'. Scale bar = 200 μm, 100x magnification. Difference between groups was assessed by Kruskal-Wallis nonparametric test followed by Dunn's multiple comparison test (**A, B, D, F**) and Kolmogorov-Smirnov test (**C**). *p<0.05, **p<0.01, ***p<0.001, ****p<0.0001; ns, not significant. Data expressed as mean±SE.

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Conflict of Interest

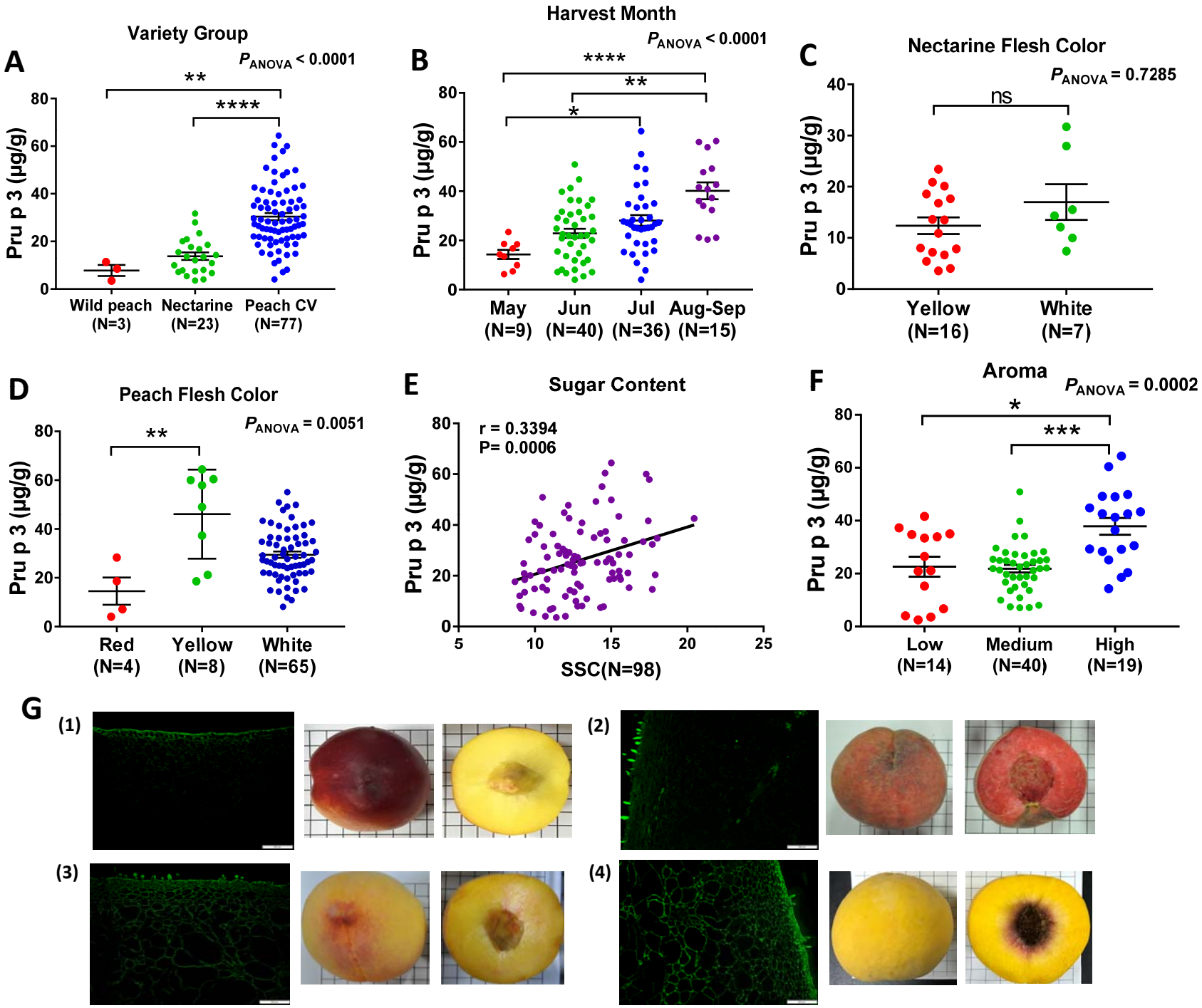
Gao ZS has received grants from National Natural Science Foundation of China (31272131) and the Key Project for New Agricultural Cultivar Breeding in Zhejiang Province (2016C02052-5), Dr. Li XW has received grant from Shanghai Science and Technology Committee Rising-Star Program; Dr. Jia HJ has received grants from National Natural Science Foundation of China (31372040) and the Key Project for New Agricultural Cultivar Breeding in Zhejiang Province (2016C02052-5). The remaining authors declare that they have no relevant conflict of interests.

Authors' contributions

ZSG, RvR and JHJ conceived and planned the study. JJ, GL, LZ, XWL, HBX and KXG collected peach samples and extracted total proteins. JJ, LG, LZ, JBN, SDW and SAV established ELISA method and data analyses. XWL, KC, ZWY, JL, RJM, KC, MJC, PA and HJJ selected the core peach collection. MLL and HYW performed the diagnosis and skin prick tests. JJ, GL, ZSG, XWL and RvR wrote the manuscript. All authors read and approved the final manuscript.

Keywords

Allergen; peach; Pru p 3; hypoallergenic varieties; protein quantification


A
Variety Group
P_{ANOVA} < 0.0001
**
****
Pru p 3 (µg/g)
0
20
40
60
80
Wild peach (N=3)
Nectarine (N=23)
Peach CV (N=77)
B
Harvest Month
P_{ANOVA} < 0.0001
****
**
*
Pru p 3 (µg/g)
0
20
40
60
80
May (N=9)
Jun (N=40)
Jul (N=36)
Aug-Sep (N=15)
C
Nectarine Flesh Color
P_{ANOVA} = 0.7285
ns
Pru p 3 (µg/g)
0
10
20
30
40
Yellow (N=16)
White (N=7)
D
Peach Flesh Color
P_{ANOVA} = 0.0051
**
Pru p 3 (µg/g)
0
20
40
60
80
Red (N=4)
Yellow (N=8)
White (N=65)
E
Sugar Content
r = 0.3394
P= 0.0006
Pru p 3 (µg/g)
0
20
40
60
80
5
10
15
20
25
SSC(N=98)
F
Aroma
P_{ANOVA} = 0.0002
*
***
Pru p 3 (µg/g)
0
20
40
60
80
Low (N=14)
Medium (N=40)
High (N=19)
G
(1)
(2)
(3)
(4)

Detailed methods used:

1. Preparation of fruit samples

Soluble solid content (SSC) was measured with a digital refractometer (ATAGO, PR-101α), and peach aroma intensity was classified subjectively as light, medium or strong (Supplementary Table 1) based on the Descriptors and Data Standard for Peach [1]. For 24 varieties (**Table S2**), the peel and pulp were separated: for melting peaches, this can easily be done by hand, while for nectarines a knife peeler was used, with 1 mm thickness.

2. Immunocytochemical localization of Pru p 3

Four varieties 'Hu You 278', 'Xue Bu Dai', 'Mei Jin' and 'Jin Shuo' were used for immuno-cytochemical localization with specific monoclonal antibody 4-1 used in ELISA quantification above. The EnVision two steps method was used for immunocytochemical analysis. Harvested fruits were sectioned and fixed in FAA. After recovering the allergen by boiling in citrate buffer solution (0.01M, pH6.0) for 20 min, sections were exposed to 3% H_2O_2 in methanol for 10 minutes to quench endogenous peroxidase activity, and nonspecific binding was blocked by incubation in PBS containing 5% BSA for 30 minutes. Peach tissue sections were incubated with anti-Pru p 3 antibody 4-1 (1mg/ml) at a titer of 1:100 overnight at 4℃. After washing, sections were incubated with the secondary antibody labeling with green fluorescence Alexa Fluor 488 goat anti-mouse IgG (H + L) for 1 hour, with exposure to a substrate chromogen mixture for 10 minutes. Green color was present on the section viewed under an OLYMPUS DP80 microscope after staining with hematoxylin. Images of sections from different varieties were taken with the same magnification and the same exposure time.

3. Patients and Skin Prick Test

Five patients from Shanxi and four from Zhejiang province were recruited on the basis of their clinical history and positive skin tests to peach extracts. All of them had provided the written informed consents. Written consent was obtained from all participants (or their representative) and the study was approved by the local ethics committee (authorization No. 2011-R-1, Second Affiliated Hospital, College of Medicine, Zhejiang University), in collaboration with the Third People's Hospital of Datong, Shanxi (authorization No. 2015-001) A serum sample from each patient was taken during the first visit and was kept frozen at –40 ° C until used. Skin tests to fresh peach were performed by skin prick test, following the technique described by Dreborg and Foucard [2].

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Supplementary Table 1. List of 103 core peach varieties and their basic fruit traits with Pru p 3 content.

Code	Variety	Pedigree	Origin country	Fruit trait*	SSC (%)	Aroma	Maturity time	Pru p 3 (ug/g FW)
1	Mao Tao 1	Wild peach for rootstock	Zhejiang province, China	PWR	9.4	L	Early August	3.47
2	Xue Bu Dai	Landrace	Henan province, China	PRR	12.0	L	Early July	4.00
3	Hu You 278	Rui Guang 3×May Fire	Shanghai, China	NYR	10.7	L	Middle June	4.02
4	Hu You 005	Rui Guang 3×May Fire	Shanghai, China	NYR	9.9	L	Middle June	5.42
5	May Fire	Seeding Selection of Armking	USA	NYR	11.4	L	Late May	3.54
6	Armking	Palomar × Springtime	USA	NYR	11.0	L	Early June	6.68
7	Zi Xue Tao	Landrace	Zhejiang province, China	PRR	9.1	L	Late June	7.12
8	Zhong You Tao 11	Zhong You Tao 5×SD9238(Rui Guang 3x May fire)	Henan province, China	NYR	11.2	M	Late June	7.18
9	Zao Hong Zhu	Jing Yu×A369	Beijing, China	NWR	14.3	M	Late May	7.41
10	Zhong You Tao 8	Hong Shan Hu×Sunshine	Henan province, China	NYR	14.5	L	Middle July	7.85
11	Wu Yue Xian	Landrace	Shanxi province, China	PRR	9.0	L	Middle June	8.02
12	Pan Tao Wang	Early Red 2×Zao Lu Pan Tao	Henan province, China	PWF	13.1	M	Early June	8.13
13	Mao Tao 2	Wild peach for rootstock	Zhejiang province, China	PYR	11.9	L	Early August	8.53
14	Zhong Nong Jin Hui	Rui Guang 2×Armking	Henan province, China	NYR	12.8	M	Early June	9.07
15	Zhong You Tao 12	6-2×SD9238 (Ruiguang 3 x Mayfire)	Henan province, China	NWR	12.7	M	Late May	9.97
16	Jin Xia You Pan	Xia Guang×‘NF’	Jiangsu,China	NYF	13.4	L	Early July	10.89
17	Mao Tao 3	Wild peach for rootstock	Zhejiang province, China	PWR	12.4	L	Middle August	11.35
18	Chun Mei	（Zao Hong 2×Flatpeach)×(Rui Guang 3×May Fire)	Henan province, China	PWR	12.0	M	Early June	11.87
19	Zhong You Tao 5	Rui Guang 3×May Fire	Henan province, China	NWR	9.0	L	Early June	12.13
20	Chao Li Chun	Ruiguang 3 x Mayfire	Beijing, China	NYR	9.3	L	Late May	13.53
21	Zhong You Tao 4	Ruiguang 16×May Fire	Henan province, China	NYR	12.6	M	Early June	13.62
22	Jin Xia	75-3-9(Okubo×Okitsu)×75-6-18(Okitsu)	Shanxi province, China	NWR	12.3	M	Early July	14.30
23	Zao Mei	Qing Feng×Zhao Xia	Beijing, China	PWR	10.8	M	Late May	14.33

24	Jin Yuan	Jin Xiu×75-1-3	Shanghai, China	PWR	17.7	L	Late July	14.61
25	Hakuri	Feicheng Tao	Japan	PWR	16.2	L	Middle July	14.84
26	Zao Hong Lu	Armking×81-3-3	Bejing,China	NWR	10.5	M	Early June	15.50
27	Zao Jiu Bao	Bud mutation from Okubo	Shanxi province, China	PWR	13.0	M	Early July	15.82
28	Rui Guang 2	Jingyu x NJN76	Beijing, China	NYR	12.8	M	Late May	16.77
29	Hu You 018	Rui Guang 3×May Fire	Shanghai, China	NYR	8.7	M	Middle June	17.64
30	Chun Lei	Sunago Wase×Bai Xiang Lu	Shanghai, China	PWR	9.3	M	Late May	18.43
31	Jin Xiang	Bei Nong 2×60-27-7	Shanghai, China	PYR	15.6	H	Middle July	18.58
32	Nan Fang Jin Mi	(Sunred×Maravilha）1-15 x Shu Guang	Henan province, China	NYR	14.9	M	Late May	18.59
33	Yang Tao	Landrace	Zhejiang province, China	PWR	10.8	M	Middle June	18.62
34	Hang Mi 1 Hao	unknown	Zhejiang province, China	PWR	15.2	M	Early July	18.93
35	Sha Hong Tao	Bud mutation from Kurakato Wase	Shaanxi province, China	PWR	15.6	M	Early July	19.67
36	Zi Jin Hong 1 Hao	Natural seed cultivated by embryo rescue	Jiangsu, China	NYR	9.7	L	Early June	20.12
37	Ling Shen 1 Hao	Landrace	Zhejiang province, China	PWR	17.9	H	Early September	20.38
38	Li You 5 Hao	unknown	Zhejiang province, China	NYR	9.3	L	Late June	20.89
39	Ling Shen 2 Hao	Landrace	Zhejiang province, China	PWR	16.1	L	Early September	21.11
40	Jin Xiu Huang Tao	Bai Hua ×Yun Shu 1	Shanghai, China	PYR	15.1	M	Early August	21.14
41	Dong Feng Da Hong Tao	Landrace	Shanxi province, China	PWR	12.58	M	Middle June	21.27
42	Meng Lu Shui Jing	Seedling	Zhejiang province, China	PWR	15.5	M	Middle July	21.88
43	Zao Hong Tao	60-4-1）×Er Yuan Tao	China	PWR	10.5	L	Early June	21.90
44	Chun Mi	89-3-16（Zao Hong 2×Li He Pan Tao）×SD9238（Rui Guang 3×May Fire）	Henan province, China	PWR	10.4	M	Early June	21.91
45	Xue Xiang Lu	Bai Hua×Chu Xiang Mei	Jiangsu province, China	PWR	11.3	M	Middle June	22.09
46	Zhong Pan Tao 10	Hong Shan Hu×91-4-8(NJN78×Feng Hua Pan Tao)	Henan province, China	PWR	11.7	M	Middle June	22.59
47	Ying Guang You Tao	unknown	Zhejiang province, China	NWR	12.6	M	Late May	23.42

48	Xia Cui	Yu Hua 2 ×77- 1- 6((Bai Hua×Tachibana Wase)×Zhao Xia)	Jiangsu province, China	PWR	12.4	M	Late June	23.95
49	Reddomun	Bai Feng×Bai Tao	Japan	PWR	12.2	M	Early July	24.48
50	Da Guan 1 Hao	Selected from Nunomewase	Henan province, China	PWR	9.3	M	Early June	24.81
51	X1-4	Yu Lu×Hu Jing Mi Lu	Zhejiang province, China	PWR	13.0	M	Early July	24.91
52	Kawanakajima Hakuto	Found in White peach and Shang Hai Shui Mi mixed garden	Japan	PWR	15.1	M	Early July	24.94
53	Okubo	Seedling of Hakuho	Japan	PWR	13.14	M	Early July	25.17
54	Okubo Late	Seedling of Okubo	Shanxi province, China	PWR	13.14	H	Middle July	25.17
55	Xin Hong	Landrace	Zhejiang province, China	PWR	14.1	M	Early July	25.20
56	Hu Jing Mi Lu	Seedling of Hakuho	Jiangsu province, China	PWR	14.7	M	Middle July	25.43
57	Zao Feng Huang	unknown	Zhejiang province, China	PWR	12.5	L	Middle June	26.25
58	Yumyeong	Da Hua Zao Sheng×Bu Mu Zao Sheng or Okubo×Bu Mu Zao Sheng	Korea	PWR	15.0	L	Middle July	26.51
59	Xin Yu	Landrace	Zhejiang province, China	PWR	14.9	M	Middle July	26.77
60	Springtime	Luken's Honey X July Elberta	USA	PWR	10.0	M	Early June	26.88
61	Akatsuki	Bai Tao×Bai Feng	Japan	PWR	12.8	M	Early July	27.26
62	X1-7	Yu Lu×Hu Jing Mi Lu	Zhejiang province, China	PWR	10.8	M	Early July	27.31
63	Mei Shuai	Okubo×90-1(Ba Yue Cui×Jing Yu)	Hebei province, China	PWR	12.6	M	Middle July	27.67
64	Zhong You Tao 13	unknown	Henan province, China	NYR	12.1	M	Early June	27.95
65	Asama Hakuto	Bud mutation from Kouyou Hakuto	Japan	PWR	16.2	M	Middle July	28.28
66	Yu Lu	offspring of Shanghai Shumi	Zhejiang province, China	PWR	15.5	H	Late July	28.36
67	Wasesimizu	Early variation of Shang Hai Shui Mi	/	PWR	11.6	L	Middle June	28.70
68	Mei Shuo	‘Jinyu' selfing	Hebei province, China	PWR	12.3	M	Early June	29.17
69	Hakuho	Shanghai Cling	Japan	PWR	12	M	Middle July	29.66

70	Hong Sha Zi	seedling	Shaanxi, China	PWR	11.8	M	Early June	30.58
71	Sunago Wase	Seedling	Japan	PWR	10.6	M	Middle June	31.50
72	Zhong You Tao 14	90-1-25[25-17(Jing Yu×NJN76)×Hake]×SD9238	Henan province, China	PWR	11.5	M	Early June	31.73
73	Qing Tao	Seedling	Zhejiang province, China	PWR	17.7	H	Early September	32.34
74	Qin Wang	Seedling from Okubo	Shaanxi province, China	PWR	17.1	L	Middle July	33.45
75	Yan Hong	Seedling	Beijing, China	PWR	15.9	L	Late July	33.87
76	Wan Mi	seedling	Beijing, China	PWR	14.7	M	Early September	34.08
77	Dong Feng Shui Mi	Landrace	Shanxi province, China	PWR	9.6	M	Middle June	34.16
78	Nan Shan Tian Tao	Landrace	Guangdong province, China	PWR	18.0	L	Middle July	34.78
79	Qiu Bai Tao	Seedling	Zhejiang province, China	PWR	13.9	L	Late July	35.01
80	Jia Tang Tao	Landrace	Zhejiang province, China	PWR	/	H	Late July	36.06
81	Zao Lu Pan Tao	Sa Hua Hong Pan Tao×Zao Xiang Yu	Beijing, China	PWR	10.0	M	Early June	36.31
82	Nunome Wase	Seedling	Japan	PWR	11.2	H	Early June	36.43
83	Yan Feng	Landrace	Zhejiang province, China	PWR	14.3	M	Middle June	36.60
84	Jin Qiu	Yang Quan Rou Tao x Ming Xin	Shanxi province, China	PYR	13.0	L	Middle August	37.31
85	Mei Jin	‘Jinyu' selfing	Hebei province, China	PYR	14.6	L	Early July	37.42
86	Zao Zhen Bao	unknown	Zhejiang province, China	PWR	10.3	M	Late June	39.84
87	Yuan Meng	Hu Jing Mi Lu×Hakuri	Zhejiang province, China	PWR	13.1	L	Early August	40.81
88	Kurakato Wase		Japan	PWR	10.0	H	Middle June	41.33
89	Tai Yuan Shui Mi	Landrace	Shanxi province, China	PWR	17.4	L	Early August	41.66
90	Qiu Fen	Landrace	Shanxi province, China	PWR	20.5	H	Late July	42.54
91	Qiu Xiang	Seedling	Beijing, China	PWR	12.3	H	Early September	42.60
92	Hong Bu Ruan	Landrace	Shanxi province, China	PWR	15.5	M	Late July	43.35
93	Mei Gui Lu	Sunago Wase×Yu Hua Lu	Zhejiang province, China	PWR	11.9	M	Early June	44.86
94	Zhong Hua Shou Tao	Selection and breeding from the bud mutation of winter	Shandong,China	PWR	12.2	H	Early September	47.76

		peach in north China						
95	Zheng Huang 3 Hao	Zao Shu Huang Gan×Feng Huang	Henan province, China	PYR	6.2	M	Early July	49.01
96	Wan Bai Mi	Wu Yun×Bai Feng	Jiangsu province, China	PWR	14.0	H	Early September	49.22
97	Yu Lu Pan Tao	Landrace	Shanghai, China	PWF	15.0	H	Middle July	49.92
98	Taiyuan Shui Mi	Seedling	Shanxi province, China	PWR	10.5	M	Middle June	50.90
99	Jing Yu	Okubo×Xingjin You Tao	Beijing, China	PWR	14.4	L	Middle July	55.09
100	Jin Shuo	Yingqing x Yangtao	Shanghai, China	PYR	17.5	H	Early September	57.89
101	Jin Hua	Seedling of Jin Xiu	Shanghai, China	PYR	17.3	M	Late August	60.06
102	Qing Feng	Okubo×Xin Duan Yang	Beijing, China	PYR	14.6	H	Middle August	60.44
103	F2-18	Hu Jing Mi Lu×Hakuri	Zhejiang province, China	PYR	15.0	H	Early July	64.41

*****The first letter refers to P-peach, N-Nectarine; the second letter refers to flesh color: W-white, Y-Yellow flesh, R-Red flesh; the third letter refers to fruit shape: F-Flat, R-round shape

Supplementary Table 2. Pru p 3 content of peel and pulp in 24 peach varieties.

Varieties	Origin	Characteristics	Pru p 3, mean±SD, μg/g of fresh weight		
			Pulp	Peel	Whole fruit
May fire	USA	NYR	0.50±0.10	6.43±0.77	3.54±0.17
Xue Bu Dai	China	PRR	0.77±0.11	9.58±0.01	4.00±0.95
Hu You 278	China	NYR	0.34±0.20	7.63±1.09	4.02±0.84
Armking	USA	NYR	0.86±0.29	10.49±0.03	6.68±1.50
Zao Hong Zhu	China	NWR	0.63±0.01	29.9±3.81	7.41±0.55
Zhong Nong Jin Hui	China	NYR	0.26±0.01	33.57±0.66	8.02±0.66
Chao Li Chun	China	NYR	1.88±0.54	52.22±0.69	13.53±0.09
Spring Snow	USA	PWR	1.25±1.24	63.24±6.03	14.84±1.96
Hu You 018	China	NYR	0.20±0.01	77.25±5.52	17.64±0.32
Hang Mi Yi Hao	China	PWR	0.58±0.00	83.04±9.27	18.93±0.54
Ying Guang You Tao	China	NWR	2.54±0.04	111.7±5.26	23.42±0.91
Xia Cui	China	PWR	2.62±0.67	122.25±5.04	23.95±1.96
Kawanakajima Hakuto	Japan	PWR	2.56±0.05	145.0±11.3	24.94±0.64
Hu Jing Mi Lu	China	PWR	3.08±0.14	152.34±6.46	25.43±1.22
Xin Yu	China	PWR	3.95±1.23	135.65±6.95	26.77±6.17
Zao Lu Pan Tao	China	PWR	3.91±0.05	162.10±3.86	36.31±0.84
Nunome Wase	Japan	PWR	4.27±0.13	168.15±14.75	36.43±1.33
Mei Jin	China	PYR	4.78±1.85	143.00±0.02	37.42±1.78
Kurakato Wase	Japan	PWR	2.86±0.63	171.47±2.51	41.33±0.21
Mei Gui Lu	China	PWR	4.75±0.09	179.26±9.54	44.86±2.12
Zheng Huang 3 Hao	China	PYR	5.41±2.84	198.48±3.74	49.01±5.01
Yu Lu Pan Tao	China	PWF	7.26±0.25	196.72±3.28	49.92±7.07
Jin Shuo	China	PYR	7.14±0.28	199.4±4.06	57.89±3.50
Jin Hua	China	PYR	9.52±0.18	211.39±13.10	60.06±6.19

'Xue Bu Dai', 'Hu You 278', 'Mei Jin' and 'Jin Shuo' were used for Immuno-cytochemical localization; 'Hu You 278' and 'Mei Jin' were also tested for SPT. Two Flat peach '**Zao Lu Pan Tao**' and '**Yu Lu Pan Tao**' have high Pru p 3 content.